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COMMITTEE ON THE PEACEFUL USES OF
OUTER SPACE
Scientific and Technical Subcommittee
Twenty-ninth session
Agenda item 10

MATTERS RELATING TO LIFE SCIENCES, INCLUDING SPACE MEDICINE

Space biology and medicine and their contribution to solving human health problems: results and prospects

Working Paper submitted by the Russian Federation

Beginning with the flight of Yury Gagarin, the duration of space flights has gradually increased and the amount of work carried out in outer space has grown. If one were to evaluate the past 30 years of the study of man in space, three fundamental results should be underscored:

- The basic physiological effects of weightlessness and the systems most adversely affected by it have been identified;

- The stages in which the human body adapts to weightlessness have been defined;

- A system for providing medical protection during space flights has been devised.

The research conducted on a wide range of biological objects during flights of the Cosmos-series manned stations and biosatellites has made a major contribution to the study of many medical and biological problems.

In the field of gravitational biology, basic research was designed to study the role of weightlessness as an ecological factor and determine the nature of its effect on various forms of organization of life. This research provided unique material for working out the problem of the evolutionary role of the Earth's gravity.

It has been established that weightlessness does not cause gene or chromosome mutations and, as a rule, does not impair the cell-fission mechanism. At the same time, the possibility that certain physiological reactions by an organism to lack of gravity may result from modified cell behaviour has not been discounted. In future, it will be necessary to determine to what extent the effect of weightlessness depends on the type of cell differentiation and the degree of functional load. The role of the genetic apparatus in mechanisms by which an organism adapts to prolonged weightlessness should be studied in greater detail. In general, we may assume that lack of gravity does not prevent the occurrence of the basic stages in the life cycle of an organism.

By improving the experimental basis for space research and developing the necessary instruments, it was possible to conduct the Svet and Inkubator experiments on the Mir orbital station. The experiment with the Svet greenhouse (the only space-flight greenhouse in the world), in which environmental conditions were created that were fully compatible with the needs of vegetable organisms, succeeded for the first time in demonstrating that lack of gravity does not impede form-building processes or the outflow of plastic substances from leaves. As a result of this, radish roots were grown for the first time in conditions of weightlessness. Nevertheless, the questions relating to plant productivity, which proved to be lower in weightlessness conditions than on Earth, and also reproduction processes remain unresolved.

The Inkubator-2 experiment was the first experiment in the world which demonstrated that the embryonic development processes of birds could occur normally under conditions of weightlessness. Normally developed, viable chicks with active motor, feeding and vocal behaviour were hatched for the first time in weightlessness conditions, which shows that weightlessness has no direct harmful effect on the processes of embryogenesis.

In the field of space radiobiology, considerable attention has been given to research into the mechanisms of the effect of the heavy component of galactic space rays. For instance, it was demonstrated that high-energy particles cause specific damage to nuclear cell-structures. The data obtained were used to develop new concepts concerning radiation risk in order to improve the radiation security system for astronauts, which can also be utilized in interplanetary travel.

Making use of the potential of space flight and its achievements to protect health and provide medical treatment on Earth is a kind of connecting link between results and prospects and the past and the future. Work is being conducted here in a number of areas.

One such area is the transmission of various types of medical information over great distances. In order to ensure medical monitoring of the physical condition of astronauts, special methods and corresponding instruments have been developed, which make it possible to record and transmit to Earth by means of telemetry various physiological and biochemical parameters indicating

the condition of all bodily systems. This enables doctors to acquaint themselves very fully with the health of cosmonauts orbiting hundreds of miles away in outer space. The principles of this kind of remote diagnostics or "telemedicine" may be successfully used very widely on Earth. Some experience has already been acquired in the linking by satellite of hospitals, medical institutions and doctors in remote areas or on ships at sea with leading medical centres in order to transmit the information needed to carry out a diagnosis or a skilled consultation. A vivid example of the possibilities of telemedicine may be seen in the results of the "telemedical bridge" organized at the initiative of the United States National Aeronautic and Space Administration (NASA) and a number of Soviet organizations for the purpose of providing medical assistance to the victims of the earthquake in Armenia. Via a system of satellites, a "tele-bridge" was organized between the Republican Diagnostic Centre in Yerevan and four medical centres in the United States. In order to conduct consultations, use was made of voice, video and facsimile communications. More than 30 conferences were held and over 200 patients were consulted; in all, teleconferencing influenced the diagnosis and treatment of no less than 2,000 victims of the earthquake. The tele-bridge demonstrated the extremely effective nature of such a system in providing medical assistance to victims of natural disasters and highlighted the prospects for using such systems in solving many problems relating to human health care.

Another aspect of the application of the achievements of space exploration in terrestrial medicine is the use of the methodology and apparatus devised for the selection and training of cosmonauts and for the conduct of medical research in outer space. Nowadays growing use is made in terrestrial clinics of equipment on which it would be fully justified to write "made for outer space". They are distinguishable by their compactness, simplicity of operation and high reliability.

The apparatus bearing the name Argument has gained a good reputation for its use in outer space in the ultrasonic monitoring of the heart and major vessels. With its aid it is possible to examine the heart and to ascertain - from inside, as it were - the condition of its cavities and arteries and the operation of its valves and muscle. This portable apparatus is already being used successfully in ambulances, thereby greatly expanding the possibilities for emergency diagnosis of cardiovascular illnesses.

The Tonus equipment used in space medicine for muscular electrostimulation is applied in traumatological practice for strengthening the muscular system in the case of postural problems, platypodia, muscular atrophy, and also during the post-operative period to avert thrombogenesis.

The electrochemical water-quality analyser is used for hygienic and epidemiological monitoring of the purity of drinking water, groundwater and waste water. This instrument makes it possible to determine the presence of trace quantities of heavy metals and organic impurities in liquid media. It enables water to be analysed both under field conditions and in automatic monitoring systems.

The methodology used in outer-space research on the cardiovascular system can be successfully applied in the diagnosis and treatment of cardiovascular illnesses on Earth. This is because during space flight less significant changes in blood circulation are observed than in the case of sick persons. It was therefore necessary to devise a number of new techniques and instruments for analysing masses of information in order to diagnose and monitor comparatively small functional changes at the earliest stage. Use of this methodology for discerning initial functional changes opens up the possibility of forecasting harmful changes and of applying treatment in good time.

A space technique of assessing the functioning of the otological apparatus is applied in the clinical practice of otorhinolaryngology and otoneuralgia and in the professional monitoring of sportsmen and those engaged in the aeronautical professions.

The methodology used in space medicine for the psychological selection and training of persons for work under extreme conditions and for the selection of groups on the basis of psychological compatibility is being increasingly applied in terrestrial practice.

The methods and simulators devised to counter the adverse effects of prolonged weightlessness on cosmonauts are being applied in sports medicine and in the rehabilitation of sick persons.

Lastly, the study of human beings in outer space under conditions of weightlessness has greatly expanded and deepened our knowledge of human health. It may be stated that space exploration itself has enhanced "terrestrial" doctors' understanding of the mechanisms of human spatial orientation, of the vestibular apparatus and its structure and functions, and their knowledge of biomechanics, metabolism and the cardiovascular and central nervous systems.

That, in the broadest terms, is the picture of the "outer-space contribution" to the solution of problems involving human health care. Despite the already discernible results of its introduction in health-care practice, space medicine is still indebted to terrestrial medicine: the latter's experience has been utilized more than has been acknowledged. That is understandable: basically only the first steps have been taken in this direction.

Today there is very high awareness of and interest in the application of the achievements of space exploration and space medicine to health care. It is no coincidence that the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82), in one of its main recommendations, noted that all countries should have the opportunity to use the methods devised as a result of medical research in outer space. That is why it is not the first year that this question appears on the agenda of the Scientific and Technical Subcommittee of the Outer Space Committee.

As to the prospects for the development of space physiology and biology, future research may, in the most general sense, take the following directions:

- Detailed study of the causes and processes involved in the changes in basic physiological functions of the human body, differentiating the specific changes due to the physiological nature of weightlessness from the adaptive reactions of the body to that phenomenon;

- Further elaboration and modernization of ways and means of treating dysfunctions due to the effects of flight;

- Further elaboration of the theory, methods and implementation of the planned control of the state of health and work capability of the members of crews in flight;

- The calculated use of weightlessness to study general biological problems due to the effects of gravitation on living systems.

Soviet scientists specializing in space biology and medicine consider that the solution of basic problems in the aforementioned research areas will make it possible to carry out a number of projects:

(a) Creation of a specialized medical and biological laboratory (Medilab) as part of a future orbital complex. As the technical basis for the project, a number of alternate designs have been put forward for a medical centre equipped with the most up-to-date diagnostic, measuring, experimental and computer apparatus, which would be part of a new generation of orbital station. Physicians, physiologists and biologists working in the medical and biological laboratory would carry out a broad range of basic and applied in-flight research.

(b) Development of a new generation of biosatellites with a longer operational life. By 1995, the operational life of such satellites could be increased to 30 days and, by the year 2000, to 120-180 days. Moreover, opportunities for conducting various types of experiments will increase substantially. Outlays for such research would be recovered by the acquisition of new basic knowledge necessary for predicting reactions to the prolonged effects of space flight. Research conducted on biosatellites can also be used to develop and test elements of the life-support system.

(c) The Mars project. A number of medical and biological problems must be solved before a manned expedition to Mars can be carried out. One such problem is that of habitability, which must be solved through the development of a biologically complete and ecologically sound living environment capable of meeting the long-term biological needs of human beings. This question requires thorough scientific study. Existing life-support systems must be replaced by a complete living environment modelled on the Earth's biosphere. It will be necessary to create on board the spacecraft to Mars a model of the natural ecological system, whose active constituents will be human beings, animals, plants and micro-organisms. The development of such a model analog

must include regenerative systems for life support with a high coefficient of recycling.

In spite of the existing differences in the assessment of radiation levels, in general, specialists agree that, given the current degree of sophistication of technical equipment and methodologies, there is reason to hope that ways of guaranteeing the radiation safety of an expedition to Mars will be found.

The solution of psychological problems, and the psychological preparedness of human beings to undertake a flight that inevitably involves a certain degree of risk, are other important aspects of preparations for a Mars expedition.

The manned flight to Mars will also require the solution of a number of physiological problems related to a prolonged state of weightlessness (artificial gravity, on-board centrifuge).

The effective implementation of the aforementioned projects, as well as the further development of space flight as a whole, will undoubtedly benefit from the concerted efforts of many countries. On the whole, international cooperation in the field of space biology and medicine has yielded good results. Together with the scientists from different countries, our specialists are conducting diverse experiments on Earth and in outer space, and are developing research methods and equipment. For example, biochemical research has been carried out on Soviet orbital stations using the Czechoslovak Plasma and Reflotron devices (Berringer-Mannheim Company), the French Echograph apparatus for the ultrasonic study of internal organs, and the Polish Physiotest apparatus for functional tests with physical loads.

Today the international community must concentrate its efforts on priority areas in the exploration and use of outer space, and should avoid duplication and the unwarranted dissipation of resources and efforts. Experience shows that the participation of various countries in research and experiments conducted in outer space itself increases interest in space travel and stimulates the participation of those countries' industrial and scientific research organizations in space activities, which also directly benefits the national economy. Moreover, the equipment and methods developed for outer space research can subsequently be used successfully on Earth.

The process of uniting the efforts of mankind in the peaceful use of outer space is gaining momentum. The important thing is that everything done in that area should be done for the welfare and health of human beings both in outer space and on Earth.

Detailed information on the subject may be obtained from the Institute for Medical and Biological Problems, Khoroshevskoe Shosse 76-a, Moscow 123007, Russian Federation. Telex: SU VUAL 411048. Fax: 195-22-53.

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COMMITTEE ON THE PEACEFUL USES
OF OUTER SPACE

DRAFT REPORT OF THE SCIENTIFIC AND TECHNICAL SUBCOMMITTEE ON THE WORK OF ITS TWENTY-NINTH SESSION

INTRODUCTION

1. The Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space held its twenty-ninth session at United Nations Headquarters from 24 February to 5 March 1992 under the chairmanship of Professor J. H. Carver (Australia). On 24 February, the Subcommittee held a special session, open to all Member States of the United Nations, as well as to the general public, commemorating International Space Year, 1992 (ISY).

2. The Subcommittee was composed of the following Member States: Albania, Argentina, Australia, Austria, Belgium, Benin, Brazil, Bulgaria, Burkina Faso, Cameroon, Canada, Chad, Chile, China, Colombia, Czechoslovakia, Ecuador, Egypt, France, Germany, Hungary, India, Indonesia, Iran (Islamic Republic of), Iraq, Italy, Japan, Kenya, Lebanon, Mexico, Mongolia, Morocco, Netherlands, Niger, Nigeria, Pakistan, Philippines, Poland, Portugal, Romania, Russian Federation, Sierra Leone, Sudan, Sweden, Syrian Arab Republic, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland, United States of America, Uruguay, Venezuela, Viet Nam and Yugoslavia.

3. Representatives of the Centre for Science and Technology for Development, the Department of Technical Cooperation for Development and the Office of Legal Affairs of the United Nations Secretariat attended the session, as did representatives of the Economic Commission for Africa (ECA) and the Economic and Social Commission for Asia and the Pacific (ESCAP).

4. Representatives of the following specialized agencies attended the session: Food and Agriculture Organization of the United Nations (FAO), United Nations Educational, Scientific and Cultural Organization (UNESCO), World Meteorological Organization (WMO), International Atomic Energy Agency (IAEA) and United Nations Industrial Development Organization (UNIDO).

5. Representatives of the European Space Agency (ESA), the International Telecommunications Satellite Organization (INTELSAT), the Committee on Space Research (COSPAR) of the International Council of Scientific Unions (ICSU), the International Astronautical Federation (IAF) and the International Society for Photogrammetry and Remote Sensing (ISPRS) also attended the session.

6. A list of the representatives of Member States, specialized agencies and other international organizations attending the session is contained in document A/AC.105/C.1/INF/21.

7. The special session to celebrate International Space Year (ISY), sponsored by COSPAR and IAF, was addressed by the Chairman of the Space Agency Forum for International Space Year (SAFISY), Mr. Hubert Curien, Minister of Research and Technology of France, and by Dr. Louis Friedman, Executive Director of the Planetary Society, speaking on "Space Flight and Global Unification". The meeting also included a panel discussion on "Space and the Global Change Programme", with the participation of Mr. Jean-Marie Luton, Director-General of the European Space Agency; Mr. Marcio Nogueira Barbosa, Director-General of the Brazilian Institute for Space Research; Mr. Yoshihiro Ishizawa, Executive Director of the National Aerospace Development Agency of Japan; Mr. John D. Schumacher, Deputy Associate Administrator of the United States National Aeronautics and Space Administration; Mr. M. G. Chandrasekhar, Scientific Secretary of the Indian Space Research Organization; and Mr. Jean-Daniel Levi, Director-General of the Centre National d'Etudes Spatiales of France.

8. In accordance with paragraph 7 (b) (vii) of General Assembly resolution 46/45 of 9 December 1991, a symposium on the theme "Space technology and the Earth's environment" was organized by COSPAR and IAF in liaison with Member States as part of the special session. The symposium was co-chaired by Mr. George Ohring, Chairman of the COSPAR Commission on Space Studies of the Earth's Surface, Meteorology and Climate, and Mr. Dale Fester, Vice President, IAF. The presentations included: "Is the Earth Warming?" by Mr. Thomas R. Karl, Chief, Global Climate Laboratory, National Oceanic and Atmospheric Administration, United States; "Monitoring of Environmental Disasters from Weather Satellites" by Mr. Luo Jibin, Director, Satellite Meteorological Centre, China; "Novel Contributions by ERS-1 and SPOT to World Environmental and Climatological Issues" by Guy Duchossois, ESA ERS-1 Mission Manager; and "The ISY World Forest Watch: Implications for Developing Countries" by Mr. Roberto Da Cunha, Brazilian Institute for Space Research.

9. On 25 February, the Subcommittee adopted the following agenda:

1. Adoption of the agenda.

2. Statement by the Chairman.

3. General exchange of views.

4. United Nations Programme on Space Applications and the coordination of space activities within the United Nations system.

5. Implementation of the recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space.

6. Matters relating to remote sensing of the Earth by satellites, including, inter alia, applications for developing countries.

7. Use of nuclear power sources in outer space.

8. Questions relating to space transportation systems and their implications for future activities in space.

9. Examination of the physical nature and technical attributes of the geostationary orbit; examination of its utilization and applications, including, inter alia, in the field of space communications, as well as other questions relating to space communications developments, taking particular account of the needs and interests of developing countries.

10. Matters relating to life sciences, including space medicine.

11. Progress in national and international space activities related to the Earth environment, in particular progress in the geosphere-biosphere (global change) programme.

12. Matters relating to planetary exploration.

13. Matters relating to astronomy.

14. The theme fixed for special attention at the 1992 session of the Scientific and Technical Subcommittee: "Space technology and the protection of the Earth's environment: development of endogenous capabilities, in particular in the developing countries and in the context of International Space Year".

15. Other matters.

16. Report to the Committee on the Peaceful Uses of Outer Space.

Meetings and documentation

10. The Subcommittee held ____ meetings.

11. A list of the documents which were before the Subcommittee is provided in annex I to the present report.

12. Following the adoption of the agenda, the Chairman made a statement outlining the work of the Subcommittee at its current session. He also reviewed the activities of Member States in the field of space exploration, including important advances that had been achieved as a result of international cooperation during the past year.

13. At the 403rd, 405th and 407th meetings, the Chairman informed the Subcommittee that requests had been received from the permanent representatives of Cuba, Greece, Peru, Spain, Yemen and the Libyan Arab Jamahiriya, as well as from the Permanent Observer for the Holy See, to attend the session. Following past practice, those delegations were invited to attend the current session of the Subcommittee and to address it as appropriate. This was without prejudice to further requests of that nature and did not involve any decision of the Subcommittee concerning status, but was a courtesy that the Subcommittee extended to those delegations.

14. General statements were made by the following delegations: Argentina, Austria, Brazil, Bulgaria, Canada, China, Cuba, Czechoslovakia, Egypt, Germany, Hungary, India, Indonesia, Iran (Islamic Republic of), Nigeria, Pakistan, Poland, Romania, Russian Federation, Sweden, Turkey, United States of America and Uruguay. Statements were also made by the representatives of COSPAR, IAF, WMO, FAO, ISPRS and INTELSAT.

15. At the 403rd meeting, the Chief of the Outer Space Affairs Division made a statement reviewing the work programme of the Division. At the 405th meeting, the Expert on Space Applications made a statement outlining the activities carried out and planned under the United Nations Programme on Space Applications.

Technical presentations

16. During the course of session, scientific and technical presentations were made by Professor Nejat Ince, Director, Marmara Centre for Scientific and Industrial Research, Turkey, on "Alternatives to geostationary orbits"; by the astronauts Dr. Norman Thagard (United States), Dr. Roberta Bondar (Canada), and Dr. Ulf Merbold (ESA) on the International Microgravity Laboratory mission; by Dr. Thomas Carroll, Director of the National Hydrology Remote Sensing Center, Office of Hydrology, United States National Weather Service, on "Remote Sensing Technology Used in Hydrology"; by Dr. M. G. Chandrasekhar, Scientific Secretary of the Indian Space Research Organization (ISRO), on "Remote Sensing for Sustainable Village Development in India"; by Ms. M. C. Durand, Canadian Space Agency, on "The Global Change Encyclopedia"; by Dr. Arnauld Nicogossian of the United States National Aeronautics and Space Administration (NASA), on space life science research; by Mr. Greg Wilson, United States, on monitoring the Earth's environment; by Mr. Carl Picher, United States, on space exploration; by Mr. Jeff Bennett, United States, on "Mission to the Universe"; and by Mr. M. G. Chandrasekhar on space debris.

Recommendations of the Scientific and Technical Subcommittee

17. After considering the various items before it, the Subcommittee, at its ____th meeting, on ___ March 1992, adopted its report to the Committee on the Peaceful Uses of Outer Space containing its views and recommendations as set out in the paragraphs below.

I. UNITED NATIONS PROGRAMME ON SPACE APPLICATIONS AND THE COORDINATION OF SPACE ACTIVITIES WITHIN THE UNITED NATIONS SYSTEM

II. IMPLEMENTATION OF THE RECOMMENDATIONS OF THE SECOND UNITED NATIONS CONFERENCE ON THE EXPLORATION AND PEACEFUL USES OF OUTER SPACE

18. In accordance with General Assembly resolution 46/45, the Subcommittee continued its consideration of these items. In accordance with past practice, the Subcommittee considered the two items jointly.

19. The Subcommittee noted that the General Assembly, in paragraph 13 of resolution 46/45, had once again emphasized the urgency and importance of implementing fully the recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82) as early as possible. The Subcommittee also took note of paragraph 8 of the same resolution, in which the General Assembly had stated that, in the context of the Subcommittee's consideration of the item, it was particularly urgent to implement the following recommendations:

"(a) All countries should have the opportunity to use the techniques resulting from medical studies in space;

"(b) Data banks at the national and regional levels should be strengthened and expanded and an international space information service should be established to function as a centre of coordination;

"(c) The United Nations should support the creation of adequate training centres at the regional level, linked, whenever possible, to institutions implementing space programmes; necessary funding for the development of such centres should be made available through financial institutions;

"(d) The United Nations should organize a fellowship programme through which selected graduates or postgraduates from developing countries should get in-depth, long-term exposure to space technology or applications; it is also desirable to encourage the availability of opportunities for such exposure on other bilateral and multilateral bases outside the United Nations system."

20. In response to the recommendations of the Working Group of the Whole to Evaluate the Implementation of the Recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space contained in its report on the work of its fifth session, held in 1991 (A/AC.105/483, annex II, paras. 4, 5 and 6), which were endorsed by the General Assembly in paragraph 10 of resolution 46/45, the Subcommittee had before it the following documents: a report on international cooperation in the peaceful uses of outer space: activities of Member States (A/AC.105/505), containing information submitted by Member States in response to

paragraphs 4 (b) and 4 (h) of the report of the Working Group; a study on applications of space technology to integrated land and water resources management for rural development (A/AC.105/490), in response to paragraph 6 (b) (i); a review of the applications of space technology to the study of desertification in developing countries (A/AC.105/501), in response to paragraph 6 (b) (iv); and a report on the implementation of the recommendations of UNISPACE 82 (A/AC.105/504), in response to paragraph 5. In addition, the Subcommittee had before it annual reports, including information in response to paragraph 4 (c), submitted by the following international organizations: the European Space Agency (A/AC.105/506), the World Meteorological Organization (A/AC.105/507), INTELSAT (A/AC.105/508), the European Telecommunications Satellite Organization (EUTELSAT) (A/AC.105/509), the Council on International Cooperation in the Study and Utilization of Outer Space (INTERCOSMOS) (A/AC.105/511), the International Maritime Satellite Organization (INMARSAT) (A/AC.105/512) and the International Telecommunication Union (ITU).

21. In accordance with paragraph 9 of General Assembly resolution 46/45, the Subcommittee reconvened the Working Group of the Whole with a view to improving the execution of activities relating to international cooperation, particularly those included in the United Nations Programme on Space Applications, and to proposing concrete steps to increase such cooperation as well as to make it more efficient. The Working Group was chaired by Mr. Muhammad Nasim Shah (Pakistan); it held ____ meetings between 27 February and ___ March 1992 and adopted its report (A/AC.105/C.1/WG.6/L.7) on ___ March 1992.

22. Having considered the report of the Working Group of the Whole, the Subcommittee decided at its ____th meeting, on __ March 1992, to adopt that report, as contained in annex II to the present report, on the understanding that the recommendations contained therein would be carried out in accordance with paragraph 9 of General Assembly resolution 37/90 of 10 December 1982. The Subcommittee recommended that the Working Group of the Whole be reconvened the next year to continue its work.

A. United Nations Programme on Space Applications

23. Regarding the expanded United Nations Programme on Space Applications, the Subcommittee had before it the report of the United Nations Expert on Space Applications (A/AC.105/497). The report was supplemented by the statement by the Expert. The Subcommittee noted that the Programme on Space Applications for 1991 had been carried out satisfactorily and commended the work accomplished by the Expert in carrying out the work programme as endorsed by the Subcommittee at its last session.

24. The Subcommittee noted with appreciation that since its last session additional contributions had been offered by various Member States and organizations and that they had been acknowledged with appreciation in paragraph 42 of the Expert's report.

25. In this connection, the Subcommittee continued to express its concern over the limited financial resources available for carrying out the Programme and appealed to Member States to support the Programme through voluntary contributions. The Subcommittee felt that the limited resources of the United Nations should be focused on the highest priority activities and noted that the Programme on Space Applications was the priority activity of the Outer Space Affairs Division.

1. 1991-1992

(a) Long-range fellowships for in-depth training

26. The Subcommittee expressed its appreciation to the Governments of Austria, Brazil and China as well as to ESA for having offered training fellowships for the period 1991-1992, as shown in annex II to the Expert's report (A/AC.105/497). The Subcommittee noted with appreciation that the offers of fellowships were to be continued for 1992-1993 by the same Governments and organization, as indicated by the Expert in his report.

27. The Subcommittee noted that it was important to increase the opportunities for in-depth education in all areas of space science, technology and applications through long-term fellowships.

(b) Technical advisory services

28. The Subcommittee took note of the technical advisory services being provided by the Outer Space Affairs Division in support of regional space applications projects, as indicated in the report of the Expert:

(a) Collaboration with ESA on a survey and field review of projects that could benefit from remote sensing data being made available by ESA to African countries covered by ESA's two remote sensing ground receiving stations at Maspalomas, Canary Islands, Spain and Fucino, Italy;

(b) Assistance to the Government of Ecuador in promoting regional use of the remote sensing ground receiving station at Cotopaxi, Ecuador;

(c) Assistance to the Government of Chile for the preparations of the Second Space Conference of the Americas.

(c) United Nations workshops and training courses

29. With regard to the activities of the Programme carried out in 1991, the Subcommittee expressed its appreciation to:

(a) The Government of India for co-sponsoring the United Nations/ESA Workshop on Basic Space Science for Development, hosted by the Indian Space Research Organization at Bangalore, India, from 30 April to 3 May 1991;

(b) The Government of Spain, as well as FAO and ESA, for co-sponsoring the United Nations/FAO/ESA Workshop on Microwave Remote Sensing Technology, hosted by the Instituto Nacional de Técnica Aeroespacial (INTA) at the Maspalomas Space Station, Canary Islands, Spain, from 10 to 14 June 1991;

(c) The Government of China, as well as ESCAP and the Office of the United Nations Disaster Relief Coordinator (UNDRO), for co-sponsoring the United Nations/ESCAP/UNDRO Workshop on the Application of Space Techniques to Combat Natural Disasters, hosted by the State Science and Technology Commission of China at Beijing from 23 to 27 September 1991;

(d) The Government of the United States for co-sponsoring the International Training Course on Remote Sensing Applications for Environmental Assessment and Monitoring, hosted by the United States Geological Survey at Sioux Falls, South Dakota, from 9 September to 4 October 1991;

(e) The Government of Germany, as well as ESA and the Carl Duisberg Society, Berlin, for co-sponsoring the Third United Nations International Training Course on Remote Sensing Applications to Geological Sciences, hosted by the Central Institute of the Physics of the Earth, Potsdam, and the Free University of Berlin from 7 to 25 October 1991;

(f) The Government of Peru, as well as WMO and ESA, for co-sponsoring the Sixth United Nations/WMO/ESA Training Course on the Use of Visible, Infrared and Radar Sensor Systems in Hydrological and Agrometeorological Applications, hosted by the Comision Nacional de Investigacion y Desarrollo Aeroespacial at Lima from 7 to 25 October 1991.

30. The Subcommittee also noted that the United Nations, through the Programme on Space Applications, had co-sponsored and financially supported the United Nations/ECA/FAO/United Nations Environment Programme (UNEP) Regional Workshop on Remote Sensing and Geographic Information Systems for African Decision-Makers, organized in cooperation with the Government of Kenya and held at Nairobi from 26 to 30 August 1991.

31. The Subcommittee took note of the status of the 1992 programme of United Nations workshops, training courses and conferences, which included the following activities, as described in paragraph 28 of the Expert's report:

(a) A United Nations Workshop on Space Technology for Resource Development and Environment Management, to be organized in cooperation with the Governments of Ecuador and Japan for the benefit of States members of the Economic Commission for Latin America and the Caribbean (ECLAC) and to be held at Quito from 9 to 13 March 1992;

(b) The Second United Nations/Sweden Training Course on Remote Senisng Education for Educators, to be organized in cooperation with the Government of Sweden and held at Stockholm and Kiruna, Sweden, from 11 May to 12 June 1992;

(c) A United Nations/ESA/Planetary Society Workshop on Basic Space Science for Development, to be organized in cooperation with the Government of Costa Rica and held at San José in July 1992;

(d) A United Nations International Conference on Satellite Remote Sensing for Resource Management, Environmental Assessment and Global Change Studies, to be organized in cooperation with the Government of the United States and held at Boulder, Colorado, from 17 to 21 August 1992;

(e) The Seventh United Nations/FAO/WMO/ESA Training Course on the Use of Visible, Infrared and Radar Systems in Hydrological and Agrometeorological Applications, to be organized for the benefit of States members of ECA and the Economic and Social Commission for Western Asia (ESCWA) and held at the Regional Centre for Services in Surveying, Mapping and Remote Sensing (RCSSMRS) at Nairobi in September/October 1992;

(f) The Fourth United Nations Training Course on Remote Sensing Applications to Geological Sciences, to be organized in cooperation with the Government of Germany and the Carl Duisberg Society, Berlin, and hosted by the Central Institute for Physics of the Earth, Potsdam, and the Free University of Berlin in October 1992;

(g) A United Nations Conference on Communications Technology for Development, to be organized for the benefit of ESCAP member States in November 1992.

(d) Promotion of greater cooperation in space science and technology

32. The Subcommittee noted that, in conjunction with the 42nd IAF Congress held at Montreal, Canada, from 6 to 11 October 1991, the United Nations, through the Programme on Space Applications and in cooperation with the Government of Canada and IAF, had organized a pre-Congress Workshop on Space Technologies for Development from 2 to 5 October 1991, and that during the IAF Congress, the United Nations and IAF had co-sponsored a Special Session on Space Technology for Agricultural Management. The Subcommittee also noted that the United Nations had supported the participation of an expert from Argentina in the Fifth Symposium of the Society of Latin American Specialists in Remote Sensing, held at Cuzco, Peru, from 28 October to 1 November 1991.

33. The Subcommittee further noted that in 1992 the United Nations, through the Programme on Space Applications, would co-sponsor the following activities: a United Nations/COSPAR/IAF Symposium on Space Technologies in Developing Countries - Making It Happen, to be held in Washington from 28 to 30 August in conjunction with the World Space Congress; and a United Nations/ISPRS Workshop on Data Analysis, Methods and Applications, to be held in Washington on 6 and 7 August in conjunction with the 17th Congress of ISPRS.

2. 1993

United Nations workshops, training courses, seminars and conferences

34. The Subcommittee recommended the approval of the following programme of workshops, training courses, seminars and conferences proposed for 1993:

(a) United Nations Seminar on Communications for Development, for the benefit of countries in the Mediterranean and adjacent areas, to be held at Athens;

(b) United Nations Workshop on the Use of Space Techniques for Monitoring and Control of the Desert Environment, for the benefit of ESCWA member States;

(c) United Nations Regional Conference on Space Technology for Sustainable Development, for the benefit of ESCAP member States, to be held at Jakarta;

(d) International Training Course on Communications Technology for Devlopment;

(e) Regional Training Course on Communications Technology for Development;

(f) United Nations/ECA Space Conference on Africa: Addressing Africa's Management Needs;

(g) United Nations Regional Workshop on Basic Space Science in Development Programmes, for the benefit of ECA member States;

(h) United Nations/UNDRO Regional Workshop on Space Technology to Combat Natural Disasters, for the benefit of member States in the ECLAC region;

(i) United Nations/Indian Ocean Marine Affairs Cooperation (IOMAC) Workshop on Space Technology and Applications for Marine Resources, for the benefit of Member States in the Indian Ocean region.

B. International space information service

35. The Subcommittee noted with satisfaction that the Outer Space Affairs Division was in the process of developing an international space information system, including both information within the United Nations system and access to external databases.

36. The Subcommittee noted with satisfaction the publication of the document entitled "Seminars of the United Nations Programme on Space Applications: Selected Papers on Remote Sensing, Satellite Communications and Space Science"

(A/AC.105/492). It also noted that the Secretariat was preparing updated editions of the Directory on Education, Training, Research and Fellowship Opportunities in Space Science and Technology and its Applications (A/AC.105/432), the Directory of Information Systems on Space Science and Technology (A/AC.105/397/Rev.1 and Add.1) and Space Activities of the United Nations and International Organizations (A/AC.105/358) for publication during International Space Year.

C. Reports

37. The Subcommittee noted with appreciation the reports submitted to it in response to the recommendations of the Working Group of the Whole in its report on the work of its fifth session (A/AC.105/483, annex II, paras. 4, 5 and 6). It noted in particular the technical studies prepared by the Secretariat on space applications for integrated land and water resources management for rural development (A/AC.105/490) and the review of applications of space technology to the study of desertification in developing countries (A/AC.105/501).

D. Coordination of space activities within the United Nations system and inter-agency cooperation

38. The Subcommittee noted that the General Assembly, in resolution 46/45, had reaffirmed its request that all organs, organizations and bodies of the United Nations system and other intergovernmental organizations working in the field of outer space or on space-related matters should cooperate in the implementation of the recommendations of UNISPACE 82.

39. The Subcommittee noted with satisfaction that the Inter-Agency Meeting on Outer Space Activities had been convened by the Administrative Committee on Coordination (ACC) at Geneva and hosted by UNDRO from 18 to 20 September 1991 and that its report (ACC/1991/PG/12) was before the Subcommittee. The Subcommittee took note of the information provided on the progress achieved in coordinating the space activities of the organizations of the United Nations system and expressed its appreciation for the report of the Secretary-General entitled "Coordination of outer space activities within the United Nations system: programmes of work for 1992 and 1993 and future years" (A/AC.105/491).

40. The Subcommittee continued to stress the necessity of ensuring continuous and effective consultations and coordination in the field of outer space activities among organizations within the United Nations system and the avoidance of duplication of activities.

E. Regional and interregional mechanisms of cooperation

41. The Subcommittee noted that the General Assembly, in its resolution 46/45, had reaffirmed its approval of the recommendation of UNISPACE 82 regarding the establishment and strengthening of regional mechanisms of

cooperation and their promotion and creation through the United Nations system. The Subcommittee noted with satisfaction that, in carrying out various activities in the implementation of the recommendations of UNISPACE 82, the Secretariat had sought to strengthen those mechanisms.

42. The Subcommittee noted with appreciation the efforts undertaken as part of the United Nations Programme on Space Applications, in accordance with the UNISPACE 82 recommendation concerning the development of indigenous capabilities, to establish regional centres for space science and technology education in existing national or regional educational institutions in developing countries, as outlined in the report entitled "Centres for Space Science and Technology - a progress report" (A/AC.105/498). The Subcommittee noted with appreciation the offers by a number of Member States to host a regional centre and urged other Member States to support the centres. The Subcommittee requested the Outer Space Affairs Division to make every possible effort to obtain the support of other relevant international organizations and requested that it be kept informed of further developments on the subject.

43. The Subcommittee took note of the contributions made by other international organizations towards the promotion of international cooperation in space activities: FAO was continuing its activities relating to remote sensing of renewable natural resources, including training courses, support of development projects and monitoring environmental conditions for the FAO Early Warning System on Food and Agriculture; ITU was continuing its work in the international coordination of space communications, including planning the 1992 World Administrative Radio Conference, providing technical assistance to developing countries and assisting in the development of the Regional African Satellite Communication System (RASCOM); WMO was continuing international cooperative programmes using space technology, including the World Weather Watch and the Tropical Cyclone Programme; INMARSAT was continuing to develop its satellite communication system for maritime, land-mobile and aeronautical communications, including the development of small, low-cost terminals and the provision of technical assistance and training; INTELSAT was further developing its system for international satellite communications, including its programmes for training and technical assistance; ESA was continuing its programme of international cooperative space activities, including training programmes for the benefit of developing countries, support of the activities of the United Nations Programme on Space Applications and technical assistance projects.

44. The Subcommittee took note of the Agreement on Joint Activities in the Study and Utilization of Outer Space signed by the members of Commonwealth of Independent States and submitted to the Subcommittee by the Russian Federation (A/AC.105/C.1/L.179). The Subcommittee noted with appreciation the support provided to the United Nations Programme on Space Applications by the former Soviet Union and expressed the hope that such support would be continued by the States members of the Commonwealth of Independent States.

45. The Subcommittee emphasized the importance of regional and international cooperation in making the benefits of space technology available to all countries, through such cooperative activities as shared payloads, dissemination of information on spin-off benefits, ensuring compatibility of space systems and providing access to launch capabilities at reasonable cost.

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DRAFT REPORT OF THE SCIENTIFIC AND TECHNICAL SUBCOMMITTEE ON THE WORK OF ITS TWENTY-NINTH SESSION

Addendum

III. MATTERS RELATING TO REMOTE SENSING OF THE EARTH BY SATELLITES INCLUDING, INTER ALIA, APPLICATIONS FOR DEVELOPING COUNTRIES

1. In accordance with General Assembly resolution 46/45, the Subcommittee continued its consideration of this item.

2. In the course of the debate, delegations reviewed the national and cooperative programmes in remote sensing. Examples were given of national programmes in developing and developed countries and of international programmes based on bilateral, regional and international cooperation, including programmes of technical cooperation between developing countries. Countries with advanced capabilities in the field, including some developing countries, described programmes to provide assistance to other developing countries.

3. The Subcommittee took note of the continuing programmes of China, France, India, Japan, the Russian Federation, the United States and ESA for remote-sensing satellites as well as the planned remote-sensing satellite systems of Brazil and Canada. It also took note of the remote-sensing activities of FAO for mapping, assessment and management of renewable natural resources for the benefit of developing countries and of UNESCO in the area of education and training in remote sensing, particularly for oceanography. The Subcommittee heard special presentations on remote sensing by experts from Canada, India and the United States, as mentioned in paragraph 16 of the present report.

4. The Subcommittee reiterated its view that remote-sensing activities should take into account the need to provide appropriate and non-discriminatory assistance to meet the needs of the developing countries.

5. The Subcommittee emphasized the importance of making remote-sensing data and analysed information available to all countries at reasonable cost and in a timely manner. The Subcommittee also recognized the need for continuing free access to data from operational meteorological satellites.

6. The Subcommittee felt that international cooperation in the use of remote-sensing satellites should be encouraged, both through coordination of the operations of ground stations and through regular meetings between satellite operators and users. It noted the importance of compatibility and complementarity of existing and future remote-sensing systems. The Subcommittee also noted the importance, particularly for the developing countries, of sharing experiences and technologies, of cooperation through international and regional remote-sensing centres and of joint work on collaborative projects.

7. Recalling General Assembly resolution 41/65 of 3 December 1986, by which the Assembly had adopted the Principles Relating to Remote Sensing of the Earth from Outer Space, the Subcommittee recommended that at its thirtieth session it continue its discussion on remote-sensing activities conducted in accordance with those principles, during its consideration of the agenda item concerning remote sensing.

8. The Subcommittee recommended that the item be retained on its agenda as a priority item for the next session.

IV. USE OF NUCLEAR-POWER SOURCES IN OUTER SPACE

9. In accordance with General Assembly resolution 46/45, the Subcommittee continued its consideration of this item.

10. In accordance with General Assembly resolution 46/45, the Working Group on the Use of Nuclear Power Sources in Outer Space was reconvened to resume its work at the current session. The Working Group met from 26 February to ___ March under the chairmanship of Professor J. H. Carver (Australia). At a meeting held on ___ March 1992, the Working Group adopted its report (A/AC.105/C.1/WG.5/L.28).

11. At its ____th meeting, on ___ March 1992, the Subcommittee adopted the report of the Working Group, which is contained in annex III to the present report.

12. The Subcommittee agreed that Member States should be invited to report to the Secretary-General on a regular basis with regard to national and international research concerning the safety of nuclear-powered satellites.

13. The Subcommittee agreed that further studies should be conducted on the problem of the collision of nuclear-power sources with space debris and that it should be kept informed of the results of such studies. The Subcommittee took note of a working paper submitted by the Russian Federation (A/AC.105/L.180) containing preliminary results of studies on the question.

14. The view was expressed that it would be desirable for IAEA to continue to provide technical views and expert services on issues on which it had relevant experience.

15. The Subcommittee recommended that the item be retained on its agenda for the next session.

16. The Subcommittee also recommended that the question of reconvening the Working Group on the Use of Nuclear Power Sources in Outer Space be considered by the Committee at its next session in the light of the work carried out by the Legal Subcommittee on the subject at its thirty-first session.

V. QUESTIONS RELATING TO SPACE TRANSPORTATION SYSTEMS AND THEIR IMPLICATIONS FOR FUTURE ACTIVITIES IN SPACE

17. In accordance with General Assembly resolution 46/45, the Subcommittee continued its consideration of this item.

18. In the course of the discussion, delegations reviewed the national and international cooperative programmes in space transportation systems, including expendable launchers, reusable space shuttles, space stations and research on aerospace planes. In particular, the Committee noted that China was continuing the use and development of its Long March series of launch vehicles; that India was continuing development of the Augmented Satellite Launch Vehicle and the Polar Satellite Launch Vehicle and had initiated development of a Geostationary Satellite Launch Vehicle; that Japan was continuing its development of the H-II and M-5 launch vehicles and conducting research on the H-II Orbiting Plane (HOPE); that the Russian Federation was continuing the space transportation programme of the Soviet Union in cooperation with other countries of the Commonwealth of Independent States, including the use of expendable launchers and of the crewed Mir space station; that the United Kingdom was studying, in cooperation with the Russian Federation, the air-launched, reusable HOTOL launch system; that the United States was continuing its programme of expendable launches and flights of the reusable Space Shuttle and was developing the Space Station Freedom in cooperation with Canada, Japan and ESA as well as conducting research for the National Aerospace Plane; and that ESA was continuing development of the Ariane series of launch vehicles and the crewed Hermes space plane. The Subcommittee heard a special presentation by astronauts from Canada, the United States and the European Space Agency on the International Microgravity Laboratory Mission, as mentioned in paragraph 16 of the present report.

19. The Subcommittee stressed the importance of international cooperation in space transportation in order to provide all countries with access to the benefits of space science and technology.

20. The Subcommittee recommended that consideration of the item be continued at its next session.

VI. EXAMINATION OF THE PHYSICAL NATURE AND TECHNICAL ATTRIBUTES OF THE GEOSTATIONARY ORBIT; EXAMINATION OF ITS UTILIZATION AND APPLICATIONS, INCLUDING, INTER ALIA, IN THE FIELD OF SPACE COMMUNICATIONS, AS WELL AS OTHER QUESTIONS RELATING TO SPACE COMMUNICATIONS DEVELOPMENTS, TAKING PARTICULAR ACCOUNT OF THE NEEDS AND INTERESTS OF DEVELOPING COUNTRIES

21. In accordance with General Assembly resolution 46/45, the Subcommittee continued its consideration of this item.

22. In the course of the discussion, delegations reviewed national and international cooperative programmes in satellite communications, including progress in communications satellite technology that would make satellite communications more accessible and less expensive and increase the communications capacity of the geostationary orbit and the electromagnetic spectrum. The Subcommittee took note of studies and research on the use of multiple, low-orbiting satellites for low-cost satellite communications. The Subcommittee heard a special presentation on alternatives to the geostationary orbit for satellite communications, as mentioned in paragraph 16 of the present report.

23. Some delegations expressed the view that the geostationary orbit was a limited natural resource and that saturation should be avoided in order to ensure that all countries had non-discriminatory access to the orbit. Those delegations felt that a special regime was required to ensure equitable access by all States, particularly developing countries. They felt that the roles of ITU and the Committee on the Peaceful Uses of Outer Space with respect to the geostationary orbit were complementary. Other delegations expressed the view that questions relating to the geostationary orbit were being addressed effectively in ITU.

24. Some delegations expressed the view that in considering the question of equitable access, account should be taken in particular of the characteristics of the equatorial countries.

25. Some delegations noted that the use of the geostationary orbit, like other orbits, was affected by the problem of space debris and that efforts were needed to minimize the generation of debris in the orbit.

26. The Subcommittee recommended that consideration of the item be continued at its next session.

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DRAFT REPORT OF THE SCIENTIFIC AND TECHNICAL SUBCOMMITTEE ON THE WORK OF ITS TWENTY-NINTH SESSION

Addendum

VII. MATTERS RELATING TO LIFE SCIENCES, INCLUDING SPACE MEDICINE

1. In accordance with General Assembly resolution 46/45, the Subcommittee continued its consideration of this item. The Subcommittee heard a special presentation on the question by an expert from the United States, as mentioned in paragraph 16 of the present report. The Subcommittee took note of a working paper submitted by the Russian Federation (A/AC.105/C.1/L.182).

2. The Subcommittee noted with appreciation the study prepared at its request by the Secretariat on applications of biomedical technology resulting from space life-science research (A/AC.105/500).

3. The Subcommittee took note of the programmes of space life-science research in Canada, Germany, the Russian Federation and the United States. The Subcommittee noted that studies of human physiology under the microgravity conditions of space flight had led to important advances in medical knowledge in such areas as blood circulation, the vestibular apparatus, physiology, biomechanics and metabolism. It noted that important new information in these fields had been obtained through experiments on board the Mir space station, and during the Spacelab Life Sciences mission and the International Microgravity Laboratory mission. The Subcommittee also noted that products of space biotechnology, such as pharmaceuticals and diagnostic and therapeutic instruments, could contribute to improved health care on Earth.

4. The Subcommittee noted that applications of space technologies were demonstrating growing promise in medicine and public health. Satellite remote sensing was being used for the prediction of the spread of vector-borne diseases such as malaria and for the planning of more effective vector control

campaigns. Satellite communications were being used for telemedicine services to provide expert medical advice to distant areas, as illustrated by the Telemedicine Spacebridge linking medical centres in the United States and the Soviet Union. The Subcommittee noted the importance of space technology for these purposes and encouraged further research and exchange of information on those applications.

5. The Subcommittee noted that space studies in life sciences and medicine had important potential benefits for all countries and that efforts should be made to promote international cooperation to enable all countries to benefit from those advances. In this connection, the Subcommittee recalled that the General Assembly, in resolution 46/45, had considered it particularly important that all countries should have the opportunity to use the techniques resulting from medical studies in space.

6. The Subcommittee recommended that consideration of the item be continued at its next session.

VIII. PROGRESS IN NATIONAL AND INTERNATIONAL SPACE ACTIVITIES RELATED TO THE EARTH ENVIRONMENT, IN PARTICULAR PROGRESS IN THE GEOSPHERE-BIOSPHERE (GLOBAL CHANGE) PROGRAMME

IX. THE THEME FIXED FOR SPECIAL ATTENTION AT THE 1992 SESSION: "SPACE TECHNOLOGY AND THE PROTECTION OF THE EARTH'S ENVIRONMENT: DEVELOPMENT OF ENDOGENOUS CAPABILITIES, IN PARTICULAR IN THE DEVELOPING COUNTRIES AND IN THE CONTEXT OF INTERNATIONAL SPACE YEAR"

7. In accordance with General Assembly resolution 46/45, the Subcommittee continued its consideration of the item concerning progress in national and international space activities related to the Earth environment, in particular progress in the International Geosphere-Biosphere (Global Change) Programme.

8. In accordance with General Assembly resolution 46/45, the Subcommittee paid special attention to the theme "space technology and the protection of the Earth's environment: development of endogenous capabilities, in particular in the developing countries and in the context of international space year". The Subcommittee noted with satisfaction that, at its invitation and as part of the special session for International Space Year, COSPAR and IAF had organized a symposium on the theme on 24 February 1991. The Subcommittee expressed appreciation to COSPAR and IAF for the very instructive symposium.

9. The Subcommittee also noted the contribution of the Outer Space Affairs Division to the preparations for the United Nations Conference on Environment and Development.

10. The Subcommittee noted the progress being made through international cooperation in the International Geosphere-Biosphere Programme, with the participation of many countries. It noted that such a joint international

effort was of fundamental importance for examining the future habitability of the planet and for managing the common natural resources of the Earth. The Subcommittee took particular note of the need to involve as many nations as possible in the scientific activities of the Programme, both in developed and in developing countries.

11. The Subcommittee took note of the important contributions of satellite remote sensing for monitoring, preventing and reversing land degradation, for planning the sustainable development of rural areas, for water conservation, for monitoring crop conditions and for predicting and assessing drought. It noted that the recent launches of the European Remote Sensing (ERS-1) satellite, the Japanese Earth Resources Satellite (JERS-1) and the Almaz satellite would provide valuable microwave data to complement the multispectral data from Landsat, SPOT, the Indian Remote Sensing (IRS) satellites and the Marine Observations Satellites (MOS).

12. The Subcommittee noted the important contribution of meteorological and atmospheric research satellites for studying global climate change, including the greenhouse effect and the degradation of the ozone layer. The recent launches of the Upper Atmosphere Research Satellite and the Meteor satellite carrying the Total Ozone Mapping System provide important new tools for this purpose.

13. The Subcommittee noted the need for further space research relating to climate change, sea-level change, vegetation cover, erosion, flood and earthquake prediction and relief, and other factors related to the Earth environment. The Subcommittee recognized the important contribution that satellite remote sensing and meteorology could make to the study of those dynamic environmental phenomena.

14. The Subcommittee took note of activities being planned for the study of the environment from space, including the Mission to Planet Earth programme. It noted, in particular, plans for the Earth Observing System, the Priroda ecological module and the TOPEX/Poseidon oceanographic satellite.

15. The Subcommittee noted the potential benefits of the use of space technology for monitoring the tectonic activity of the Earth for earthquake prediction. It noted the importance of further research in that area.

16. The Subcommittee noted the importance of international cooperation in the various existing and planned satellite systems for environmental monitoring. It recommended that other States consider participating in such cooperative activities.

17. The Subcommittee recommended that consideration of the item be continued at its next session.

X. MATTERS RELATING TO PLANETARY EXPLORATION

XI. MATTERS RELATING TO ASTRONOMY

18. In accordance with General Assembly resolution 46/45, the Subcommittee continued its consideration of these items. The Subcommittee heard special presentations on the items by experts from the United States, as mentioned in paragraph 16 of the present report.

19. The Subcommittee noted that three planetary exploration missions were currently under way. The Magellan spacecraft was in orbit around Venus and was conducting a systematic radar mapping programme of that planet. The Galileo spacecraft was on a complex trajectory to Jupiter and had recently made the first close observations of an asteroid. The Ulysses spacecraft had successfully made a swing-by manoeuvre of Jupiter on its long trajectory to observe the polar regions of the Sun. The Subcommittee also noted the plans for future spacecraft to conduct comprehensive investigations of Mars and Saturn and its moons. The Subcommittee noted the high degree of international cooperation in all of those investigations and stressed the need to further enhance international cooperation in this field, to enable all countries to benefit from and participate in those activities.

20. The Subcommittee noted that the use of spacecraft for making astronomical observations from above the atmosphere had greatly advanced knowledge of the universe by allowing observations in all regions of the electromagnetic spectrum. It noted that with the Hubble Space Telescope, the Rosat X-ray observatory, the Gamma and Granat astrophysical observatories, the Compton Gamma Ray Observatory and the Hipparcos spacecraft, astronomers had powerful new tools for their investigations of the universe. The planned launches of the Lyman Far Ultraviolet Spectroscopic Explorer (FUSE), the Radioastron satellite, the Spektr-Roentgen-Gamma observatory, the Advanced X-ray Astrophysical Facility, the Space Infra-Red Telescope Facility, the Infrared Space Observatory and the Extreme Ultraviolet Explorer would open up further realms of the universe to detailed observation. The Subcommittee noted with satisfaction that all of those projects were open to broad international cooperation.

21. The Subcommittee recommended that consideration of the items be continued at its next session.

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Addendum

XII. OTHER MATTERS

A. International Space Year - 1992

1. The Subcommittee noted that the General Assembly, in its resolution 46/45, has recommended that the Scientific and Technical Subcommittee, at its 1992 session, should dedicate at least one meeting to International Space Year. The Subcommittee expressed its appreciation to COSPAR and IAF for sponsoring and assisting in the organization of the special session on 24 February 1992 to celebrate International Space Year as described in paragraph ___ of the present report. The Subcommittee also expressed its appreciation to all those who contributed to the special session.

2. The Subcommittee took note of the proposed programme for the participation of the United Nations in ISY (A/AC.105/445 and Add.1-7) and noted that a guidebook describing the programme had been distributed to Member States. The Subcommittee noted that the General Assembly, in its resolution 46/45, had urged Member States, international organizations and other funding sources to support the efforts of the United Nations in connection with International Space Year.

3. The Subcommittee noted that the participation of the United Nations in ISY was funded by voluntary contributions. The Subcommittee expressed its appreciation to the Member States and international organizations that had made voluntary contributions for this purpose or were planning to do so. The Subcommittee urged other Member States and international organizations to further support scientific and technical activities in cooperation with the United Nations as part of International Space Year.

4. The Subcommittee noted that a focus of international ISY activities was the use of space technology for studying and monitoring the environment. It also noted that the General Assembly, in resolution 46/45, had reiterated its recommendation that Member States, in planning their activities for ISY, should consider ways in which those activities could complement the efforts under way for the United Nations Conference on Environment and Development, also planned for 1992. The Subcommittee noted the cooperation between the Outer Space Affairs Division and the Conference secretariat.

5. The Subcommittee noted the wide variety of national and international programmes being undertaken as part of International Space Year, including the activities being coordinated through the Space Agency Forum on International Space Year (SAFISY), COSPAR, IAF and ISPRS. It noted in particular the plans for the World Space Congress being organized jointly by COSPAR and IAF, including activities organized in cooperation with the United Nations. The Subcommittee also noted the importance of including all countries in those programmes and of planning activities that would continue beyond 1992. The Subcommittee heard a special presentation by an expert from Canada on the Global Change Encyclopedia being prepared for ISY as mentioned in paragraph ___ of the present report.

6. The Subcommittee requested the Secretariat to keep the Committee and the Subcommittee informed of further developments relating to this question.

B. Space and Earth environment

7. The Subcommittee noted that the General Assembly, in resolution 46/45, had recommended that more attention be paid to all aspects related to the protection and preservation of the outer space environment, especially those potentially affecting the Earth's environment. The Subcommittee also noted that the General Assembly had considered that it was essential that Member States pay more attention to the problem of collisions with space debris, and other aspects of space debris, and had called for the continuation of national research on that question and for the development of improved technology for the monitoring of space debris.

8. The Subcommittee noted that the General Assembly had considered that, to the extent possible, information relating to the question of space debris should be provided to the Subcommittee in order to allow it to follow that question more closely and had requested the Secretary-General to invite Member States to provide information on their national research on space debris to the Subcommittee. The Subcommittee took note of the information that had been submitted by Member States in response to that request and that was contained in document A/AC.105/510 and Add.1 to 3. The Subcommittee heard a special presentation on the subject by an expert from India, as mentioned in paragraph ___ of the present report.

9. The Subcommittee reaffirmed that there was a need for further research concerning space debris, for the development of improved technology for monitoring space debris and for the compilation and dissemination of data on space debris. It also noted the importance of reducing the generation of space debris, in particular debris resulting from explosions, and of identifying disposal orbits into which satellites could be placed at the end of their operational lifetime. It further noted the importance of international cooperation in addressing these issues.

10. The Subcommittee noted that the General Assembly, in resolution 46/45, had considered that space debris could be an appropriate subject for in-depth discussion by the Committee on the Peaceful Uses of Outer Space in the future.

11. The Subcommittee agreed that information on national research on space debris should be provided to the Subcommittee, as in the past. This could be done through provision of working papers, interventions in the general debate and technical presentations by specialists from Member States and COSPAR and IAF.

12. Some delegations expressed the view that the question of space debris should be included on the Subcommittee's agenda at its next session, allowing for a general exchange of views and information. Other delegations, while recognizing the importance of the subject, expressed the view that such consideration was premature until further national research on the problem of space debris had been completed.

13. The Subcommittee took note of a working paper submitted by Poland (A/AC.105/C.1/L.181) calling for the preparation of a report on the preservation and protection of the outer space environment, especially activities potentially affecting the Earth environment.

14. The Subcommittee took note of a working paper submitted by Czechoslovakia (A/AC.105/C.1/L.184) concerning a definition of space debris and a possible format for the discussions relating to space debris in the Committee on the Peaceful Uses of Outer Space and its subcommittees.

C. Other reports

15. The Subcommittee welcomed the annual reports of ESA (A/AC.105/506), WMO (A/AC.105/507), INTELSAT (A/AC.105/508), EUTELSAT (A/AC.105/509), INTERCOSMOS (A/AC.105/511) and INMARSAT (A/AC.105/512), and the preliminary version of the thirty-first report of ITU on telecommunication and the peaceful uses of outer space. The Subcommittee requested those organizations to continue to report on their work.

16. The Subcommittee expressed its appreciation to COSPAR for its report on the progress of space research during the period 1990-1991 (A/AC.105/502) and to IAF for its report on highlights in space technology and applications during 1991 (A/AC.105/503). The Subcommittee noted that these reports will be

published jointly for dissemination to a wider audience as suggested by the Subcommittee at its twenty-eighth session.

17. The Subcommittee noted with appreciation the participation in its session of representatives from United Nations bodies, specialized agencies and permanent observers, and found their statements and reports helpful in enabling the Subcommittee to fulfil its role as focal point for international cooperation in space.

D. Review of the future role and work of the Scientific and Technical Subcommittee

18. The Subcommittee recommended that the agenda of its thirtieth session include the following priority items:

(a) Consideration of the United Nations Programme on Space Applications and the coordination of space activities within the United Nations system;

(b) Implementation of the recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82);

(c) Matters relating to remote sensing of the Earth by satellites including, inter alia, applications for developing countries;

(d) Use of nuclear-power sources in outer space.

19. The Subcommittee also recommended that the agenda of the thirtieth session include the following items:

(a) Questions relating to space transportation systems and their implications for future activities in space;

(b) Examination of the physical nature and technical attributes of the geostationary orbit; examination of its utilization and applications, including, inter alia, in the field of space communications, as well as other questions relating to space communications developments, taking particular account of the needs and interests of developing countries;

(c) Matters relating to life sciences, including space medicine;

(d) Progress in national and international space activities related to the Earth environment, in particular progress in the geosphere-biosphere (global change) programme;

(e) Matters relating to planetary exploration;

(f) Matters relating to astronomy;

(g) The theme fixed for special attention at the 1993 session of the Scientific and Technical Subcommittee: "Space-based communication: the expansion of current services and increased understanding of new systems and the services they will make possible".

20. The Subcommittee recommended that, regarding agenda item (g) in paragraph 19 above, COSPAR and IAF, in liaison with Member States, should be invited to arrange a symposium, with as wide a participation as possible, to be held during the first week of the Subcommittee's session, to complement discussions within the Subcommittee on the special theme.

21. With regard to the dates for the thirtieth session, the Subcommittee recommended that its session be scheduled from 16 to 26 February 1992.

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Agenda item 15

OTHER MATTERS

Space debris

Working paper submitted by Czechoslovakia

For the text of the working paper, see document A/AC.105/510/Add.2 (pp. 2 to 5).

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